

WHAT IS CLAIMED IS:

1. A method for mixing at least two fluids comprising:
 - (a) introducing the at least two fluids into a common first conduit which includes a junction with a second conduit and transporting
5 the fluids to the junction, and
 - (b) subjecting the fluids in the first conduit at the junction to a force in order to alternately change the direction of flow of the fluids and thus increasing the interfacial area between the fluids in the first
10 conduit to increase the rate of mixing between the fluids in the first conduit.
2. The method of claim 1, wherein the force is produced by at least one of:
 - an alternating electrical field,
 - an alternating mechanical energy source, preferably at least one
15 of positive and negative pressure or vacuum.
3. The method of claim 1, wherein the transport of the fluids towards the junction is achieved by at least one of:
 - (a) an electric field, and/or
20 (b) a pressure differential.
4. The method of claim 1, comprising at least one of the features:

force is applied across the first conduit at the junction perpendicular or substantially perpendicular to the fluid flow in the first conduit;

the force is applied at the junction utilizing the second conduit;

25 the force applied at the junction is alternated after a certain time

interval which allows at least a substantial amount of the fluids in the first conduit to move using the force from one conduit wall to the opposite conduit wall;

5 the force applied at the junction is constantly alternated after a time interval which is dependent on at least one of the following parameters: channel geometry, fluid viscosity, temperature;

the force applied at the junction is changed from one direction or polarity to the opposite direction or polarity after each time interval;

10 the strength of the force applied at the junction is sufficient to move at least a substantial amount of the fluids in the first conduit from one conduit wall to the opposite conduit wall within a given time interval.

5. The method of claim 2, comprising at least one of the features:

the alternating electric field applied produces a current of at least $\pm 1\mu\text{A}$;

15 the alternating electric field or the alternating mechanical energy is applied at the two ends of the second conduit;

the alternating electric field across the junction is produced by arranging at least one electrode at each of the two ends of the second conduit.

20 6. The method of claim 1, wherein the fluids are transported electrokinetically at least within the first conduit.

7. The method of claim 6, wherein during application of the force at the junction, the transport currents for the respective fluids are increased or decreased.

8. The method of claim 1, wherein the strength of the force is increased with increasing mixing time.
9. The method of claim 1, comprising at least one of the features:
- 5 a fluid is carried in the second conduit and contains charged or chargeable molecules or particles;
- a fluid is carried in the second conduit and contains charged or chargeable molecules or particles and a buffer solution is carried in the second conduit;
- 10 the at least two fluids comprise charged or chargeable components, preferably ions.
10. Use of the method according to claim 1 to mix fluids containing at least one component from any of the following groups: peptides, polypeptides, nucleic acids, carbohydrates, dyes, fatty acids.
11. An apparatus for mixing at least two fluids, comprising:
- 15 a first conduit adapted for receiving the at least two fluids, wherein the first conduit comprises a junction with a second conduit,
- a first source of energy adapted for transporting the fluids to the junction,
- 20 a second source of energy adapted for subjecting the fluids in the first conduit at the junction to an alternating force in order to alternately change the direction of flow of the fluids and thus increasing the interfacial area between the fluids in the first conduit to increase the rate of mixing between the fluids in the first conduit.
12. Microfluidic device for mixing at least two fluids where the microfluidic

device comprises:

a substrate having at least one microchannel formed in a surface of the substrate;

a cover plate arranged over the substrate surface;

5 a first conduit and a second conduit for mixing the at least two fluids defined by the cover plate covering the microchannel wherein the second conduit forms a junction with the first conduit and the first conduit is intended for passage of the at least two fluids;

10 a first source of energy adapted for transporting the fluids within the first conduit; and

15 a second source of energy adapted for subjecting the fluids in the first conduit at the junction to an alternating force in order to alternately change the direction of flow of the fluids and thus increasing the interfacial area between the fluids in the first conduit to increase the rate of mixing between the fluids in the first conduit.

13. Microfluidic device according to claim 12, wherein the second energy source is comprised of at least two electrodes located in the second conduit wherein at least one electrode is arranged on each side of the junction.